Appendix A

Current Activities and Programs

OFFICE OF THE SECRETARY OF DEFENSE

Open Systems Joint Task Force

The Open Systems Joint Task Force (OS-JTF), established by the Office of the Under Secretary of Defense, Acquisition Technology and Logistics (USD[AT&L]), is responsible for providing support for the modular, open-system approach (MOSA), as well as the insertion of commercial open-system technology and products into U.S. Department of Defense (DoD) systems. OS-JTF funds pilot programs and demonstrations with industry to ensure the feasibility of process changes for modular, open systems. OS-JTF is also involved in setting industry standards, international military standards, and determining how they apply to DoD. Working with and providing support for program managers to develop system upgrades or new systems, OS-JTF ensures that lessons learned about modular open systems and pending standards are understood.

Joint Technical Architecture

The Assistant Secretary of Defense (ASD) Command, Control, Communications, and Intelligence (C3I) issued a memorandum on November 14, 1995, to command, service, and agency principals involved in the development of command, control, communications, computers, and intelligence (C4I) systems about addressing the need for joint operations in combat and the reality of a shrinking budget. Recipients of the memorandum were directed to "reach a consensus of a working set of standards" and "establish a single, unifying DoD technical architecture that will become binding on all future DoD C4I acquisitions" so that "new systems can be born joint and interoperable, and existing systems will have a baseline to move towards interoperability" (personal communication with V. Garber, director of interoperability, OUSD [AT&L], November 30, 2000).

The Joint Technical Architecture Group, chaired by ASD(C3I), was formed. Using the U.S. Army Technical Architecture as a starting point, JTA 1.0 Version was released on August 22, 1996, and immediately mandated by the USD (AT&L) and ASD(C3I) for all new and upgraded C4I systems (DoD, 1999).

The development of JTA 2.0 began in March 1997 under the direction of a Technical Architecture Steering Group, cochaired by ASD(C3I) and USD(A&T) OS-JTF. The applicability of Version 2.0 was expanded to include information technologies in all DoD systems (DoD, 1999).

Development of JTA 3.0 began in June 1998. JTA 3.0 includes additional subdomain annexes and incorporates the newly developed DoD technical reference model to ensure that references to standards throughout the document are integrated (DoD, 1999).

Joint Strike Fighter

The Joint Strike Fighter (JSF) Program is a significant new DoD program focused on proactive measures to address the issue of aging avionics in the future. The JSF Program faces three challenges. First, it must develop processes for an affordable, effective, evolvable family of weapon systems with an operational lifetime of more than 30 years, even though most product lifetimes are less than five years. Second, the new weapons systems must be developed according to the system acquisition procedures, which include compliance with acquisition reform processes and the open systems policy; at the same time proprietary information must be protected and the integrity of competition maintained. Third, the new weapons systems must meet the needs of both warfighters (by providing real-time operation, safe flight, and security) and the needs of logisticians (by designs for reliability and maintainability, that facilitate easy upgrades and include plans for dealing with obsolescence). The JSF Program, which is committed to funding a MOSA strategy to meet these challenges, has been collaborating with industry and academia since 1994.

Defense Advanced Research Projects Agency/ Information Technology Office Embedded Software

The Defense Advanced Research Projects Agency (DARPA) formed a Tiger Team in the Information Technology Office to determine the potential of improving embedded software in DoD systems. The Tiger Team will address concerns about the growing problem of integrating embedded software in the large, complex systems. Surprisingly, DARPA has determined that the cost of integrating embedded software is 40 to 50 percent of the acquisition cost and growing. Therefore, DARPA is sponsoring studies and pilot programs to establish a new process for reintegrating physical and information sciences. The purpose of these programs is to suggest two new technologies to support this process change.

Defense Microelectronics Activity

The Defense Microelectronics Activity (DMEA) was established by DoD to provide a broad spectrum of microelectronic services. Located in Sacramento, California, DMEA is under the direction and control of the Deputy Under Secretary of Defense for Logistics. Because DMEA is the DoD activity involved with the obsolescence of microelectronics, it has sponsored a number of government and industry initiatives to address the growing problems of sustainment and obsolescence.

DMEA's primary mission is to leverage the capabilities and payoffs of advanced technology to solve operational problems in existing weapon systems, increase operational capabilities, reduce operation and support costs, and reduce the effects of diminishing manufacturing sources (DMS). DMEA assists weapon systems program managers by providing advanced microelectronics technologies, ensuring long-term sustainment of these systems, and providing studies and analyses of current and future sustainment problems.

Diminishing Manufacturing Sources and Material Shortages Teaming Group

The Office of the USD(AT&L) established the Diminishing Manufacturing Sources and Material Shortages (DMSMS) Teaming Group to address the issue of component obsolescence. Members of the DMSMS Teaming Group, who represent DoD programs and industry, are working together to find solutions to common component obsolescence problems. The Teaming Group maintains a database of current information on component obsolescence and, whenever possible, explores resolutions that will work for all programs faced with the obsolescence problem, often reducing the cost. Membership in the DMSMS Teaming Group is open to all procuring activities. Currently, no membership or computer usage fees are required.

Government Industry Data Exchange Program

The Government Industry Data Exchange Program (GIDEP) is a cooperative, government-industry program to reduce costs by making maximum use of existing data. The program provides a medium of exchange for technical information and data essential for research, design, development, production, and sustainment.

GIDEP is managed and funded by the U.S. government and chartered by the Joint Logistics Commanders. Participating organizations include: U.S. Army, U.S. Navy, U.S. Air Force, Defense Logistics Agency, National Aeronautics and Space Administration, U.S. Department of Energy, U.S. Department of Labor, Federal Aviation Administration (FAA), U.S. Postal

Service, National Security Agency, U.S. Department of Commerce, General Services Administration, and the Canadian Department of Defense. Hundreds of commercial companies that produce hardware for the government also participate in the program. GIDEP has been selected by the DoD to be the central repository for DMSMS-related information.

Defense Logistics Agency/Defense Supply Center Columbus

In 1987, the Defense Logistics Agency (DLA) contracted with the Sarnoff Corporation, in collaboration with the Defense Supply Center Columbus, for generalized emulation of microcircuits (GEM) to begin research on replacing older microcircuits, from the earliest form of integrated circuits (ICs) to modern ICs. Using Sarnoff's on-site foundry, computer-aided design software, and comprehensive knowledge of IC design and development, GEM produces circuit replacements that match the form, fit, and function (FFF) requirements of the original part.

The objective of the GEM program is to make available an economical, rapid delivery source of FFF-equivalent microcircuits to support readiness requirements for military equipment. The goal of GEM is to develop a generic emulation system with the capability of supporting on-demand production of microcircuits based on modern technologies.

The GEM alternative provides at least two major benefits. First, it reportedly provides digital microcircuits at approximately one-tenth the cost and in one-quarter the time required for developing and testing a redesign alternative. Second, the GEM system design includes a reuse strategy to ensure that design and fabrication building blocks are catalogued, promote cost containment (i.e., least cost for multiple users), and ensure the long-term availability of families of microcircuit devices (personal communication with Justine Corboy, Sarnoff Corporation, July 25, 2000).

Shared Data Warehouse

The DMS Shared Data Warehouse is being developed by the Division of Industrial Support Program (DLA) to enable DoD to manage parts obsolescence. The objective of the DMS Shared Data Warehouse is to minimize the impact of DMS on DoD weapon systems. The Shared Data Warehouse promotes a systematic, single methodology for processing notices of discontinuance and provides a central repository for DMS management. Using business-type process evaluations, in addition to existing screening processes, the DMS Shared Data Warehouse provides rapid, economical identification, dissemination, and processing of affected part numbers and national stock numbers.

AIR FORCE

Aeronautics Systems Center's Affordable Combat Avionics

The Air Force received an action item from the Quarterly Acquisition Program Review in October 1998 to present a plan for studying the design of avionics systems to preclude their obsolescence. The Affordable Combat Avionics Office has been the single most active Air Force organization addressing the problem of aging avionics (Raggio, 2000). First, they are attempting to institutionalize open-system avionics architectures by providing policy guidance and direction to program managers. Second, they are sponsoring studies with industry and working with original equipment manufacturers to identify challenges and exchange ideas. Third, the chief architect is establishing a process for integrated-change road maps to identify opportunities for pilot programs.

The Affordable Avionics Initiative, under the authority of Aeronautic System Center and located at Wright Patterson Air Force Base, has done an excellent job of promoting activities to reduce the total ownership cost (TOC) of new and legacy military avionics systems. It has initiated related discussions and studies with industry, is working closely with the OSD OS-JTF, and is becoming a recognized focal point for aging avionics issues in the Air Force. However, its effectiveness in dealing with current DMS problems and weapons-system modernization has been hampered by the lack of an Air Force (and DoD) enterprise strategy, as well as by the current independent program management structure.

To correct these problems, the Air Force has placed the Affordable Avionics Initiative under the authority of the recently created Aging Aircraft System Program Office (SPO), which will be headed by a general officer. The charter for this office includes not only aging avionics, but also all aspects of force sustainment with the aging inventory (i.e., aging airframes, engines, support equipment, and training systems).

Diminishing Manufacturing Sources and Material Shortages Program

The Air Force Materiel Command (AFMC) asked the Air Force Research Laboratory (AFRL) to provide DMSMS support for weapons systems in its command (AFMC, 2000). AFRL established a DMSMS hub to reduce the impact of obsolescence by distributing discontinuance notices, developing tools and databases for identifying and resolving problems, and ensuring the continued availability of parts to support requirements for current and planned weapon systems. The DMSMS Hub has also been chartered to develop more centralized, coordinated DMSMS management, including support for tracking databases, developing new tool capabilities, and training.

The DMSMS Hub collaborates on numerous OSD and Air Force-level DMSMS-related programs and issues, including initiatives on aging avionics, aging aircraft, open-systems architecture, and operational, safety, suitability and effectiveness. The AFMC DMSMS Hub's Internet web site (*http://www.ml.afrl.af.mil/ib/dpdsp/dmsms.htm*) provides important information, policies and regulations, a calendar of upcoming and recent events, tools and publications, information about the AFMC DMSMS Teaming Group, and links to other DMSMS-related web sites and Air Force DMSMS-related initiatives and focal points.

Electronic Parts Obsolescence Initiative

The AFRL, Materials and Manufacturing Directorate, Manufacturing Technology Division, Wright-Patterson Air Force Base, has implemented a five-year, $21 million initiative to deal with parts obsolescence and the Application of Commercially Manufactured Electronics (BAA-98-14-MLKT) (Bumbalough, 2000). In addition, contractors are providing more than $11 million for this initiative. The initiative consists of eight programs in the following areas: (1) commercially available obsolescence-management decision and reverse-engineering tools; (2) application of commercially manufactured electronics to address key technology-driven issues at the chip, board, and box level; and (3) pilot programs to improve business policies and obsolescence-management processes by using tools and technologies from other areas and to demonstrate and document the cost effectiveness of implementing them into weapon systems.

NAVY

Naval Aviation Systems Team

The Naval Aviation Systems Team is addressing the issue of aging avionics through proactive studies and pilot programs to prevent the problem from affecting the readiness and availability of Navy aircraft. The Navy has established an enterprise team to study aging avionics in legacy systems. The team looks for ways to use open-systems designs that do not require major system upgrades and to continue the Navy's tradition of using common avionics systems to reduce TOC. An organizational problem for the Naval Aviation Systems Team is that program managers are generally assigned life-cycle responsibility for a program but have no dedicated budgets for monitoring or managing problems associated with aging avionics (J. Johnson, 2000).

Helicopter Modernization Program

The Helicopter Modernization Program was established several years ago. A system being developed by Lockheed Martin will replace four legacy platforms in the current inventory with one basic platform (Sikorsky's H-60 helicopters) adapted to perform unique missions. The new platform will have a reusable, open-system architecture with common hardware in the cockpit and common software modules, configured to meet mission needs. The architecture will be compliant with the JTA. The Navy expects to realize a 57 percent reduction in flyaway costs and a 60 percent reduction in TOC (J. Johnson, 2000).

Diminishing Manufacturing Sources Technology Center

The Navy established a DMS Technology Center (DTC) through the Naval Surface Warfare Center, Crane Division, to produce and distribute product discontinuance notifications to those who sign up for this free service. The DTC has the capability of analyzing weapons system bills of materials and producing health assessment reports and supplemental support analyses using the technology-obsolescence, risk-assessment model (TORA), as well as analyses of solution alternatives and recommendations, with corresponding cost analyses.

ARMY

Aviation Electronic Combat Office

The Aviation Electronic Combat Office is responsible for centralized avionics management for Army aircraft systems. The office is implementing the Army's strategy for aging avionics by fostering an open-systems architecture environment and by improving obsolescence management. Using MOSA, the Army is replacing legacy systems through the modernization of major platforms. In addition, horizontal technology integration initiatives, such as the joint tactical radio system (JTRS), will provide common solutions to improve platform performance, reduce size and weight, mitigate against obsolescence, and reduce TOC.

Modernization Through Spares/Continuous Technology-Refresh Program

Obsolescence management is being addressed through preplanned product improvement programs that emphasize reliability and technology-transition plans to reduce TOC. Initially called the Modernization Through Spares Program, the program is now the Continuous Technology-Refresh Program. The rationale for the acquisition of spares is to replace obsolescent parts, maintain performance levels, and avoid failures caused by a lack of parts. Savings will be reinvested in future programs (Johnston, 2000).

Aviation Applied Technology Directorate

The Aviation Applied Technology Directorate (AATD) establishes science and technology strategy for the aviation fleet. Obsolescence and DMS have impacted not only aging aircraft, but also the Apache Longbow and Comanche platforms, which have not yet been fully fielded. AATD is addressing these problems in several ways, notably through the Rotary Open-System Architecture (ROSA) Program and ROSA-D, a demonstration program for the ROSA technology (D. Johnson, 2000).

Rotary Open-System Architecture Program

The objective of the ROSA Program is to select, develop, and evaluate key components of an open-system avionics architecture for dual application to military and civilian rotorcraft. The goal is to create a rotorcraft technical architecture for Army aircraft that would provide descriptions and design standards for high-speed networks, integrated processors, and other commercial off-the-shelf (COTS)-based components. The ROSA-D Program, which is currently unfunded, would demonstrate the applicability and feasibility of concepts developed under the ROSA Program (D. Johnson, 2000).

AEROSPACE INDUSTRY

Lockheed Martin

Proven Path

The objective of Proven Path is to bring together the best technologies and business practices throughout the company to address DMS, technology-refresh strategies, and COTS-based technology applications. The Office of the Corporate Vice President of Technology is responsible for Proven Path. All major business sectors are involved in the Proven Path initiative (Frew, 2000).

Systems, Technologies, Architecture, and Acquisition Reform

Lockheed Martin has been working with the Air Force Aging Avionics Office at Wright Patterson Air Force Base to study the problem in detail. The Systems, Technologies, Architecture, and Acquisition Reform (STAAR) Study, which involves business groups from 10 Lockheed Martin company locations, focuses on several Air Force platforms, including the F-16, F-22, F-117, C-5, and A-10. The final report will provide integrated technical and programmatic solutions to reducing the TOC for each platform. In addition, the report will recommend a business concept for leveraging cross-platform investments to enable integrated technical and programmatic solutions (Sarama, 2000).

The Boeing Company

Bold Stroke

Bold Stroke is a company-wide, company-funded avionics-affordability initiative. The program was started in 1996 at the Phantom Works but cuts across all three of Boeing's major business areas: space, military aircraft, and commercial aircraft. The objective of

Bold Stroke is to use commercially available computer technologies to provide military avionics systems for half the development cost, half the flyaway cost, and less than half the support costs of current systems. The architecture uses a layered software infrastructure to provide hardware/software isolation. Bold Stroke architecture is based on open standards that are available to all suppliers and have no proprietary "hooks" (Varga, 2000).

Open Avionics Systems Integration Study

Boeing has been working with the Air Force Aging Avionics Office on a no-cost-to-the-government study, the Open Avionics Systems Integration Study (OASIS). The study was undertaken to examine five aircraft weapon systems in detail to develop a multiplatform, open-systems solution to rapid, affordable modernization and to lower TOC. This study was conducted by Boeing company organizations representing the B-1B, B-2 (with the participation of Northrop Grumman), B-52, C-17, and F-15. The OASIS strategy began with five programs with individual road maps, evolved to the development of multiplatform integrated road maps focused on a business case-analysis process, and concluded with the development of an affordable migration strategy with open-systems architectures that would lead to the development of common, open-systems, multiple-system migration plans (Seal, 2000).

Commercial Product Offerings for Obsolescence Management

Avionics Component Obsolescence Management

The Avionics Component Obsolescence Management (AVCOM) tool, initially developed under an Air Force contract in support of the F-15 program at Warner Robins Air Force Base, is provided by Manufacturing Technology, Incorporated (MTI). Air Force participation in the development of AVCOM and its refinements have helped structure one of the best DMSMS programs in the Air Force (personal communication with Mike Amspacker, Manufacturing Technology, Inc., August 16, 2000).

AVCOM uses component information from the indentured parts breakdown of the technical order and the source control drawing describing the approved components for use in the weapon system. Once the full system structure has been loaded, any system, box, or board in this hierarchical structure can be selected and analyzed. Analyses include a listing of all next-lower assemblies, a listing of any parts that have known discontinuance announcements, a projection of part availability, and customized queries to provide custom reports. The manufacturing and availability status of all components, as well as all military-equivalent parts associated with systems in the AVCOM application, are monitored by MTI.

Transition Analysis of Component Technology, Incorporated

Transition Analysis of Component Technology, Incorporated (TACTech), is a commercial, interactive, data service that provides internally developed software and parts libraries to address obsolescence problems for semiconductors. Founded in 1987, TACTech provides component life-cycle data to DoD and more than 100 companies worldwide. TACTech's database identifies potential sourcing problems and provides projections for addressing the problem of parts obsolescence proactively. TACTech can analyze systems bills of materials and provide FFF replacement recommendations via a real-time electronic library. With TACTech's indenturing capability, analysis can be done at any level in the weapon system. Base-part numbers or generic-part numbers and parametric-part searches can be done to provide alternatives. TACTech can link users in a teaming environment to enable coordinated decision making and cost-sharing opportunities (TACTech, 2000).

The B-2 program, a team project involving ARINC, DMEA, TACTech, and Northrop Grumman, has been praised for its aggressive, proactive DMSMS program and has been singled out as a model Air Force program (B-2, 2000).

SMART Parts

The goal of SMART Parts, a program under Litton-TASC Corporation, is to reduce TOC through an innovative hardware architecture and design process that provides a brand new solution to the long-term sustainment of aging digital systems (Abrahamson, 2000). One of the most creative features of this innovative architecture is the concept of dynamic adaptability. SMART Part designs are FFF replacements for existing

circuit assemblies (CCAs). A SMART Part design can be used in a system without any system modifications and can be installed into multiple CCA locations. The function of the card adapts to meet the system requirements of the CCA it is replacing by simply setting a configuration switch to the desired function. In its purest form, the SMART Part approach could replace an entire line replacement unit (LRU) of unique CCAs with multiple instances of the same SMART Part design. The SMART Part approach works well for purely digital designs.

The SMART Part reimplementation methodology is based on the premise that the boards being replaced meet operational performance requirements but are not supportable for other reasons. By focusing on reimplementing existing designs, identical functionality can be achieved much faster than through a total redesign.

If the existing design does have functional problems and the existing function must be modified, the SMART Part design methodology also supports total redesign. SMART Part designs use "generic" components; the unprogrammed SMART Part circuit card is, in essence, a "blank slate." Firmware defines the functionality. Because there are no application-specific components in the design, SMART Part component replacements are available indefinitely. Updating the SMART Part design to accommodate new components is a comparatively quick and inexpensive task (Abrahamson, 2000).

National Rotorcraft Technology Center

The National Rotorcraft Technology Center (NRTC) is an interagency team from the National Aeronautics and Space administration (NASA), the Army, the Navy and the FAA. The NRTC, located at NASA Ames Research Center, Mountain View, California, cooperatively develops and implements dual-use rotary-wing technology that addresses both civil and military needs. The goal is to ensure the continued superiority of DoD rotorcraft systems while providing an additional dual-use benefit, thus improving the U.S. rotorcraft industry's competitiveness in the civil sector. The NRTC has been the catalyst for a paradigm shift to a new way of doing business between government and industry emphasizing cooperation, streamlined processes and minimum infrastructure (Morris, 2000).

The NRTC's primary program is an innovative approach to including U.S. industry and academia as partners through a focal point, the Rotorcraft Industry Technology Association (RITA), a nonprofit corporation formed for this purpose. RITA is jointly managed and executed. Industry provides at least 50 percent of the funding for all projects; government funding is provided to execute the program through a funded cooperative agreement established under the NASA Space Act. Technology needs are identified by the customer and are strongly focused on dual use. Projects are defined by industry (RITA) in consultation with the government. A federated approach to sharing of facilities and expertise is emphasized, and the NRTC Government Office facilitates access to government laboratories and capabilities. Research data and rights are shared among RITA members.

Software Engineering Institute

The Software Engineering Institute (SEI) is a federally funded research and development center sponsored by DoD through the Office of the USD(AT&L). DOD established SEI in 1984 via a competitive award to Carnegie Mellon University to advance the practice of software engineering to ensure that quality software could be produced on schedule and within budget (DoD, 2000).

The SEI mission is to provide leadership in advancing the state of the practice of software engineering to improve the quality of systems that depend on software. SEI promotes the evolution of software engineering from an ad hoc, labor-intensive activity that is well managed and supported by technology. SEI has been instrumental in developing the Capability Maturity Model, which measures an organization's process capabilities to produce quality software. SEI focuses on two principal areas:

- software engineering management practices, the ability of organizations to predict and control quality, schedule, cost, cycle time, and productivity when acquiring, building, or enhancing software systems
- software engineering technical practices, the ability of software engineers to analyze, predict, and control selected properties of software systems, and make key choices and trade-offs when acquiring, building, or enhancing software systems

SEI has been actively involved in work on open systems since 1993 by developing courses, related

products, and other sources of open-systems information, and working on formal standards. SEI work on software architectures has focused on the following areas: architectural evaluation techniques based on attribute-specific models; architecture reconstruction of a specific system implementation as a means of checking a system to ensure that it complies with the architecture specified for it; and to providing information on architectures and architectural concepts to stakeholders.

National Center for Advanced Technologies

In 1993, the National Center for Advanced Technologies (NCAT) formed the Industry Affordability Task Force as part of the Affordability Thrust of the Director of Defense Research and Engineering and DARPA. The task force has evolved into the Multi-association Industry Affordability Task Force, which addresses common industry and DoD science and technology, manufacturing, product and process development, commercial integration, sustainment, and defense acquisition policy and program issues.

Many successful projects featuring the coordinated efforts of various industry associations, government agencies, and key defense industry producers have been co-sponsored and facilitated by NCAT. These projects, performed by senior and executive-level industry experts, have been conducted through workshops, symposia, conferences, and team activities involving one-on-one, face-to-face interviews and group workshops. NCAT's industry experts have dealt with a variety of advanced technology, manufacturing infrastructure, and managerial technology issues in aerospace, aeronautics, avionics, electronics, propulsion, and materials manufacturing, including management technologies (NCAT, 2000).

The Air Force has solicited NCAT to support and facilitate government-industry interactions in support of the Affordable Avionics Initiative for the AFMC. Because of NCAT's affiliation with the professional and industry associations involved in the Multi-association Industry Affordability Task Force, NCAT can provide industry insight into complex issues. NCAT's structure and charter have positioned it to provide rapid responses to industry/policy issues, such as those under scrutiny by the AFMC.

Computer-Aided Life-Cycle Engineering Electronic Products and Systems Center, University of Maryland

Computer-Aided Life-Cycle Engineering Center (CALCE) is sponsored by more than 50 commercial and government organizations from all facets of the electronics systems industry. Over the last 15 years, CALCE has invested more than $50 million in developing methodologies, models, and design tools to address the design and manufacturing of electronic systems (CALCE, 2000). CALCE is recognized as a founder and driving force behind the development and implementation of physics-of-failure approaches to reliability and life-cycle prediction, as well as a world leader in accelerated testing and electronic parts selection and management. CALCE has chaired the development of several reliability and part-selection standards and is at the forefront of the development of international standards for critical electronic systems.

Located at the University of Maryland, CALCE brings together leading avionics, automotive, computer, semiconductor, and electronics manufacturers by providing information and services that match industry needs and an organizational structure in which different sectors of the electronics-industry supply chain can share information and influence practices and policies.

CALCE has been asked by avionics, airframers and end users to outline an avionics road map and transition it to industry (CALCE, 2000). The avionics road map project will address the following issues:

- chart external pressures compelling avionics manufacturers to design with commercial-grade components and subsystems
- identify necessary changes in design, support, and certification
- identify necessary changes in governing regulations and standards
- suggest ways avionics manufacturers can maximize their ability to respond quickly to obsolescence

REFERENCES

Abrahamson, C. 2000. SMART Parts. Presentation by Carl Abrahamson, Litton/TASC, to the Committee on Aging Avionics in Military Aircraft, National Research Council, Washington, D.C., June 8, 2000.

AFMC (Air Force Materiel Command). 2000. Available on line at: *http://www.ml.afrl.af.mil/ib/dpdsp/dmsms.htm*.

B-2 Stealth Bomber. 2000. Proactive DMSMS Management in the B-2 System Progam Office. Material provided to the Committee on Aging Avionics in Military Aircraft, Dayton Marriott Hotel, Dayton, Ohio, May 2, 2000.

Bumbalough, A. 2000. Electronic Parts Obsolescence Initiative. Presentation by Anthony Bumbalough, Air Force Research Laboratory, to the Committee on Aging Avionics in Military Aircraft, Dayton Marriott Hotel, Dayton, Ohio, May 3, 2000.

CALCE (Computer-Aided Life-Cycle Engineering Center). 2000. Electronic Products and Systems Center. Available on line at: *http://www.CALCE.UMD.EDU/general/center/Center/center.htm*.

DoD (U.S. Department of Defense). 1999. DoD Joint Technical Architecture (JTA) Version 3.0. Available on line at: *http://www-jta.itsi.disa.mil/*.

DoD. 2000. Software Engineering Institute, Carnegie Mellon University. Available on line at: *http://www.sei.cmu.edu/*.

Frew, R. 2000. Systems, Proven Path. Presentation by Russell Frew, Lockheed Martin, to the Committee on Aging Avionics in Military Aircraft, National Research Council, Washington, D.C., June 8, 2000.

Johnson, D. 2000. Aging Avionics Science &Technology Strategy and Program Status. Presentation by Dale Johnson, Army Aviation Applied Technology Directorate, to the Committee on Aging Avionics in Military Aircraft, National Research Council, Washington, D.C., June 8, 2000.

Johnson, J. 2000. Naval Aviation Systems Team. Presentation by James Johnson, Naval Air Systems Command, to the Committee on Aging Avionics in Military Aircraft, National Research Council, Washington, D.C., March 27, 2000.

Johnston, L. 2000. Aging Avionics. Presentation by Larry Johnston, Aviation Electronic Combat, to the Committee on Aging Avionics in Military Aircraft, National Research Council, Washington, D.C., June 8, 2000.

Morris, C. 2000. Rotocraft Center of Excellence and Rotorcraft Industry Technology Association. Presentation by Charles Morris, National Rotorcraft Technology Center, to the Committee on Aging Avionics in Military Aircraft, National Research Council, Washington, D.C., August 17, 2000.

NCAT (National Center for Advanced Technologies). 2000. MOSA. Meeting by the MOSA Industry Steering Group, National Center for Advanced Technologies, Washington, D.C., November 1, 2000.

Raggio, R. 2000. Affordable Combat Avionics. Presentation by Lt. Gen. Robert Raggio, Commander, Aeronautical Systems Center, to the Committee on Aging Avionics in Military Aircraft, Dayton Marriott Hotel, Dayton, Ohio, May 2, 2000.

Sarama,T.J. 2000. Systems, Technologies, Architectures and Acquisition Reform (STAAR) Report. Presentation by Thomas J. Sarama, Lockheed Martin, to the Committee on Aging Avionics in Military Aircraft, Dayton Marriott Hotel, Dayton, Ohio, May 3, 2000.

Seal, D.W. 2000. Open Avionics Systems Integration Study (OASIS). Presentation by Daniel W. Seal, the Boeing Company, to the Committee on Aging Avionics in Military Aircraft, Dayton Marriott Hotel, Dayton, Ohio, May 3, 2000.

TACTech. 2000. TACTech Data Service Database on obsolescence in military/aerospace devices. Available on line at: *http://www.tactech.com/*.

Varga, R. 2000. Bold Stroke. Presentation by Reg Varga, The Boeing Company, to the Committee on Aging Avionics in Military Aircraft, National Research Council, Washington, D.C., June 9, 2000.